King Fahd University of Petroleum and Minerals
College of Computer Science and Engineering
Computer Engineering Department

COE 202: Digital Logic Design (3-0-3)
Term 111 (FALL 2011)
Major Exam 1
Thursday October 13, 2011

Time: 90 minutes, Total Pages: 6

Name:_____ ID:_____ Section: _____

Notes:

- Do not open the exam book until instructed
- **Calculators are not allowed** (*basic, advanced, cell phones, etc.*)
- Answer all questions
- All steps must be shown
- Any assumptions made must be clearly stated

Question	Maximum Points	Your Points
1	22	
2	14	
3	14	
4	11	
5	14	
Total	75	

Question 1. **(22 points)**

Convert the following numbers from the given base to the other uncrossed bases listed in the table (if needed, express fractions up to 3 digits only). Show your solution steps below the table.

Decimal	**Binary**	**Octal**	**Hexadecimal**	**BCD (8421)**
37.3				
	1010101.011			
		275.2		
				00010100

Question 2. **(14 points)**

Perform the following arithmetic operations in the specified number system.

Octal Addition	Hexadecimal Subtraction	Binary Subtraction	Binary Multiplication
1775 +1734	FA3B - 27E9	11010011 - 10000101	1101 × 1100

Question 3. **(14 points)**

a. Draw the logic implementation of the function below (*use F as is*, ***do not simplify***):

$$F = \left(\overline{W} + X\ \overline{Z} \right) \left((X + W)\ Z \right)$$

b. Obtain the complement of the following function (***Don't Simplify***):

$$G\ (A,B,C,D) = A\ \left[B\,(\overline{C + D})\ +\ \overline{B}\,C\,\overline{D} \right]\ +\ \ D$$

c. *Using Algebraic manipulation*, simplify the following function to **three** literals:

$$H(A,B,C,D) = (\ B + C\ )\left(\overline{A} + D \right)\ \ +\ \ \ \overline{D}\left(\overline{A}\,C + A\,\overline{B}\ \right)$$

Question 4. **(11 points)**

I. Given the SOP Boolean function $F(x, y, z) = x + \bar{y}\,\bar{z}$

a. Express the function as a POS
b. Express the function as a sum of minterms

II. Given the function $F(A, B, C) = \sum m(0,2,3,4,6,7)$

a. Express F as a product of Maxterms
b. Give the ***algebraic*** product of Maxterms expression for F.
c. Express $\bar{F}$ as a sum of minterms and product of Maxterms

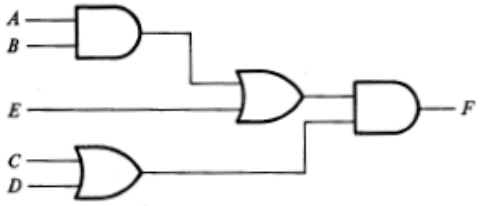
Question 5. **(14 points)**

Fill in the Spaces: (Show all work needed to obtain your answer)

a. Given that $F(A,B) = A + \overline{A}B + \overline{A}\,\overline{B}$, then the function F is 1 at _____ (how many) rows in its truth table.

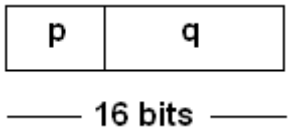
b. $F(A,B,C) = ABC + \overline{A}\,\overline{B}C + \overline{A}B\overline{C} = \Pi\, M($_____$)$

c. The logic circuit shown below is an example of _____ (how many) - level logic. If all gates have the same propagation delay of 2 ns, then the circuit takes _____ ns to produce the correct output.



d. Before sending the data 1011001 over a communication link using **even** parity, the transmitter appends a parity check bit equal to _____ (0/1) to it.

e. A 16-bit international character code consists of p bits to represent the language and q bits to represent the character. If no language requires more than 350 characters, then it is possible to support up to _____ (how many) languages.



f. For functions of the logic variables V, W, X, Y, Z, the maxterm M_3 is given in the algebraic form as _____.

g. The function $Y + \overline{X}\,\overline{Z} + X\,\overline{Y}$ can be simplified to the single maxterm: _____.